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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also included. (AG)

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Development of USES Test Battery for Electronics Foreman

(electronics) 5-92.621

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Technical Report on Development of USES Aptitude Test Battery

For .....

Electronics Foreman (electronics) 5-92.621

(726.130)

B-633
or 3
S-35

U. S. Employment Service
in Cooperation with
Wisconsin State Employment Service

October 1965

GATB Study #2570

DEVELOPMENT OF USES APTITUDE TEST BATTERY

For

Electronics Foreman (electronics) 5-92.621

B-633

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Electronics Foreman (electronics) 5-92.621. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB, B-1002 Scores
G - Intelligence	105
M - Manual Dexterity	100
V - Verbal Ability	90

RESEARCH SUMMARY

Sample:
72 male electronics foremen employed at 2 Fabri-Tek, Inc. plants at Amery and Eau Claire, Wisconsin.

Criterion:
Supervisory ratings

Design:
Concurrent (test and criterion data were collected at approximately the same time). Minimum aptitude requirements were determined on the basis of a job analysis and statistical analysis of aptitude mean scores, standard deviations, aptitude-criterion correlations and selective efficiencies.

Concurrent Validity:
Phi Coefficient = .55 ($P/2 < .0005$)

Effectiveness of Norms: Only 71% of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 91% would have been good workers. 29% of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 9% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1:

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good workers	71%	91%
Poor workers	29%	9%

SAMPLE DESCRIPTION

Size: N=72

Occupational Status: Employed workers

Work Setting: Workers were employed at 2 Fabri-Tek, Inc. plants located at Amery and Eau Claire, Wisconsin.

Employer Selection Requirements:

Education: No requirement
Previous Experience: Various other jobs within the plant.
Tests: No tests were used
Other: Personal interview and check of references.

Principal Activities: The job duties for each worker are comparable to those shown in the job description in the Appendix.

Minimum Experience: All workers in the sample had at least 4 months total job experience.

TABLE 2

Means, Standard Deviations (SD), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience

	Mean	S D	Range	r
Age (years)	24.8	4.0	19-42	.100
Education (years)	12.6	1.0	12-15	.089
Experience (mos.) (present employer)	9.1	8.7	4-46	-.140

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B were administered during 1965.

CRITERION

The criterion data consisted of supervisory ratings of job proficiency made at approximately the same time as test data were collected. Two sets of independent ratings were made by first-line supervisors with a 2 - 3 week interval between ratings.

Rating Scale: USES Form SP-21, "Descriptive Rating Scale." This scale (See Appendix) consists of nine items covering different aspects of job performance. Each item has five alternatives corresponding to different degrees of job proficiency.

Reliability: The correlation between the two independent ratings was .89. The final criterion consisted of the two sets of ratings combined.

Criterion Score Distribution:

Possible Range:	18-90
Actual Range:	36-89
Mean:	63.8
Standard Deviation:	10.7

Criterion Dichotomy: The criterion distribution was dichotomized into low and high groups by placing 29% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers."

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitudes S and M which do not have a high correlation with the criterion were considered for inclusion in the norms because the qualitative analysis indicated that Aptitudes S and M are important for the job duties and the sample had relatively high mean scores on both aptitudes.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performed)

Aptitude	Rationale
G - Intelligence	Necessary for understanding and interpreting the process of assembling electronic component parts
V - Verbal Ability	Necessary for training of workers through verbal explanations and instructions
S - Spatial Aptitude	Necessary for visual inspection of parts to determine conformance to specifications
F - Finger Dexterity	Necessary for threading wires through cores and inserting lead pins
M - Manual Dexterity	Necessary in using hand tools to cut ends of wires replace adjustors, solder wires, and connect leads

TABLE 4

Means, Standard Deviations (SD) and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N=72.

Aptitudes	Mean	SD	r
G - Intelligence	114.3	14.0	.434**
V - Verbal Aptitude	105.2	14.8	.369**
N - Numerical Aptitude	110.0	13.2	.176
S - Spatial Aptitude	118.2	17.5	.170
P - Form Perception	114.2	16.0	.033
Q - Clerical Perception	109.2	12.0	.180
K - Motor Coordination	109.3	15.2	.204
#F - Finger Dexterity	104.4	19.5	.234*
M - Manual Dexterity	121.1	19.4	.018

#N=71

*significant at the .05 level

**significant at the .01 level

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X	X		X				X	X
Irrelevant									
Relatively High Mean	X			X	X				X
Relatively Low Sigma	X	X	X			X			
Significant Correlation with Criterion	X	X						X	
Aptitudes to be Considered for Trial Norms	G	V		S				F	M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of a comparison of the degree to which trial norms consisting of various combinations of aptitudes G, V, S, F, and M at trial cutting scores were able to differentiate between the 71% of the sample considered good workers and the 29% of the sample considered poor workers. Trial cutting scores at five point intervals approximately one standard deviation below the mean are tried because this will eliminate about one third of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about 1/3 of the sample; for four-aptitude trial norms, cutting scores of slightly less than one standard deviation below the mean will eliminate about 1/3 of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of G-105, M-100 and V-90 provided the highest degree of differentiation for the occupation of Electronics Foreman (electronics) 5-92.621. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .55 (statistically significant at the .0005 level).

TABLE 6

Concurrent Validity of Test Norms, G-105, M-100 and V-90

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	11	40	51
Poor Workers	17	4	21
Total	28	44	72

Phi Coefficient (Ø) = .554 Chi Square (X^2) = 22.098
Significance Level = P/2< .0005

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study did not meet the requirements for incorporating the occupation studied into any of the 36 OAP's in Section II of the Guide to the Use of the General Aptitude Test Battery. The data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.

A-P-P-E-N-D-I-X

JOB DESCRIPTION

Job Title: Electronics Foreman 5-92.621

Job Summary: Trains female workers to wire, solder and assemble electronic components for use in Electronic Data Processing Equipment and supervises their work.

Work Performed: Trains by lecture and demonstration; assigns and coordinates the work in the assembly of Magnetic Core Memory Planes and Modules as follows:

Module Assembler: Trains workers to solder wires of magnetic memory core planes to frames by filling terminal holes with solder, to fasten wires in place and to connect leads using a soldering iron; to insert lead pins (precut wire ends) of semi-conductors, such as transistors, transformers, etc., into terminals of printed circuit boards; to clip ends of wire components with cutters and to connect lead wires to specified terminals using soldering iron; to file soldered connections smooth and to touch-up when necessary with solder; to attach color coded wires between specified component leads to make circuit connections and to attach wire to circuit for module leads using soldering iron; to assemble cables following wiring diagram and color code; and to attach inhibit and converter decks using hand tools.

Core Plane Wirer: Core Shaker - Trains workers to select proper memory plane frame and to place on tray of core shaker; to pick up vial containing proper size ferite cores as small as 2 mils. in diameter and to spread cores out on tray of core shaker; to shake cores so they fall on end into minute slots arranged in desired pattern by moving treadle to tip and shake tray; to fill any remaining slots with cores using tweezers; to tape cores in place for wiring by applying masking tape and to remove frame from tray for inspection and subsequent wiring.

Diagonal Wiring: Hands inspected memory frame to workers who place it on work bench. Trains workers to select proper needles and wires that are color coded according to work order; to string wire through cores on a diagonal angle by gently and carefully inserting tip of needle through center of each core; to keep cores from being knocked over or out of position by steadying them with a toothpick when inserting needle; to string all cores in a frame according to work order; and to use magnifying glass while wiring frame to help string cores.

Needle Soldering: Trains workers to attach proper size wires to needles used for stringing cores by using hand soldering equipment; to follow color code to insure that proper gage wires are attached to correct needle; to maintain and repair needles by sanding rough edges smooth with emery cloth and to inspect needles by feeling to determine smoothness.

Cross Wiring: Trains workers to install X and Y wires through cores by carefully pushing needle with proper wires attached through cores in the row using a toothpick to help guide point of needle; to orient cores so the ends are facing each other; to pull thread wire to proper tension and to continue to thread wires through alternate rows and in alternate directions; to wrap tail wires around frame slats using a tweezers; and to cut excess from end of wire using cutting pliers.

Inspection: Inspects all parts, in process and finished, visually and by use of electrical test equipment to determine conformance to specifications. Repairs all units found to be defective. Replaces adjuster, rewires or resolders all defective parts. Retrains workers, if necessary, to correct any malpractices that result in defective units.

SP-21
Rev. 2/61

DESCRIPTIVE RATING SCALE
(For Aptitude Test Development Studies)

Score____

RATING SCALE FOR _____
D. O. T. Title and Code

Directions: Please read Form SP-20, "Suggestions to Raters", and then fill in the items listed below. In making your ratings, only one box should be checked for each question.

Name of Worker (print) _____
(Last) (First)

Sex: Male_____ Female_____

Company Job Title: _____

How often do you see this worker in a work situation?

☐ See him at work all the time.

☐ See him at work several times a day.

☐ See him at work several times a week.

☐ Seldom see him in work situation.

How long have you worked with him?

☐ Under one month.

☐ One to two months.

☐ Three to five months.

☐ Six months or more.

A. How much work can he get done? (Worker's ability to make efficient use of his time and to work at high speed.)

☐ 1. Capable of very low work output. Can perform only at an unsatisfactory pace.

☐ 2. Capable of low work output. Can perform at a slow pace.

☐ 3. Capable of fair work output. Can perform at an acceptable but not a fast pace.

☐ 4. Capable of high work output. Can perform at a fast pace.

☐ 5. Capable of very high work output. Can perform at an unusually fast pace.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

☐ 1. Performance is inferior and almost never meets minimum quality standards.

☐ 2. The grade of his work could stand improvement. Performance is usually acceptable but somewhat inferior in quality.

☐ 3. Performance is acceptable but usually not superior in quality.

☐ 4. Performance is usually superior in quality.

☐ 5. Performance is almost always of the highest quality.

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

☐ 1. Makes very many mistakes. Work needs constant checking.

☐ 2. Makes frequent mistakes. Work needs more checking than is desirable.

☐ 3. Makes mistakes occasionally. Work needs only normal checking.

☐ 4. Makes few mistakes. Work seldom needs checking.

☐ 5. Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with his work.)

☐ 1. Has very limited knowledge. Does not know enough to do his job adequately.

☐ 2. Has little knowledge. Knows enough to "get by."

☐ 3. Has moderate amount of knowledge. Knows enough to do fair work.

☐ 4. Has broad knowledge. Knows enough to do good work.

☐ 5. Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

☐ 1. Has great difficulty doing his job. Not at all suited to this kind of work.

☐ 2. Usually has some difficulty doing his job. Not too well suited to this kind of work.

☐ 3. Does his job without too much difficulty. Fairly well suited to this kind of work.

☐ 4. Usually does his job without difficulty. Well suited to this kind of work.

☐ 5. Does his job with great ease. Exceptionally well suited for this kind of work.

F. How large a variety of job duties can he perform efficiently? (Worker's ability to handle several different operations in his work.)

☐ 1. Cannot perform different operations adequately.

☐ 2. Can perform a limited number of different operations efficiently.

☐ 3. Can perform several different operations with reasonable efficiency.

☐ 4. Can perform many different operations efficiently.

☐ 5. Can perform an unusually large variety of different operations efficiently.

G. How resourceful is he when something different comes up or something out of the ordinary occurs? (Worker's ability to apply what he already knows to a new situation.)

☐ 1. Almost never is able to figure out what to do. Needs help on even minor problems.

☐ 2. Often has difficulty handling new situations. Needs help on all but simple problems.

☐ 3. Sometimes knows what to do, sometimes doesn't. Can deal with problems that are not too complex.

☐ 4. Usually able to handle new situations. Needs help on only complex problems.

☐ 5. Practically always figures out what to do himself. Rarely needs help, even on complex problems.

H. How many practical suggestions does he make for doing things in better ways? (Worker's ability to improve work methods.)

☐ 1. Sticks strictly with the routine. Contributes nothing in the way of practical suggestions.

☐ 2. Slow to see new ways to improve methods. Contributes few practical suggestions.

☐ 3. Neither quick nor slow to see new ways to improve methods. Contributes some practical suggestions.

☐ 4. Quick to see new ways to improve methods. Contributes more than his share of practical suggestions.

☐ 5. Extremely alert to see new ways to improve methods. Contributes an unusually large number of practical suggestions.

I. Considering all the factors already rated, and only these factors, how acceptable is his work? (Worker's "all-around" ability to do his job.)

☐ 1. Would be better off without him. Performance usually not acceptable.

☐ 2. Of limited value to the organization. Performance somewhat inferior.

☐ 3. A fairly proficient worker. Performance generally acceptable.

☐ 4. A valuable worker. Performance usually superior.

☐ 5. An unusually competent worker. Performance almost always top notch.

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